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Study of human skin based on scanning probe microscopy

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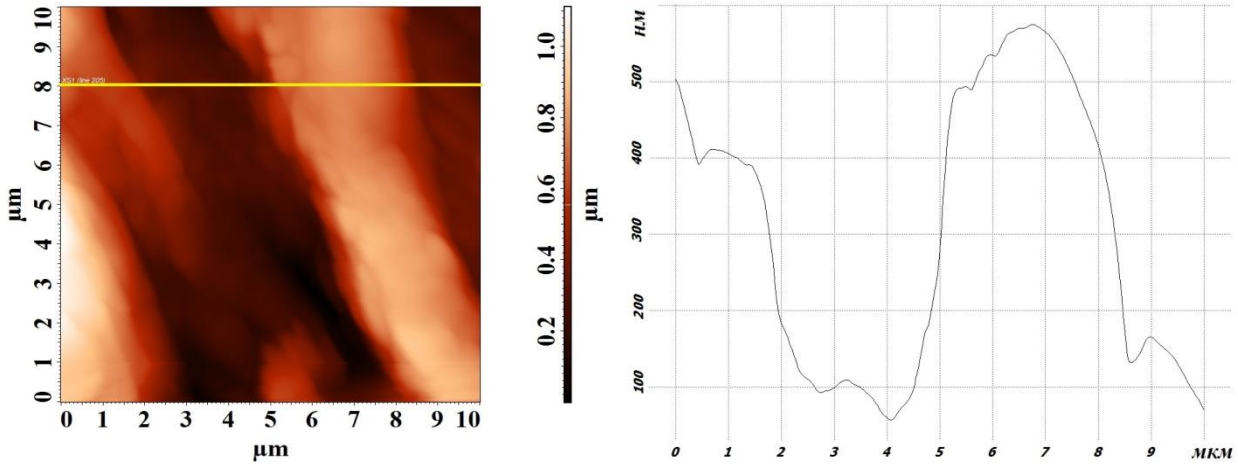
In this paper a method of biometric identification with high reliability based on measuring the elastic properties of the skin of a human finger while scanning his finger prints is presented. This method is shown to allow with a high degree of veracity to distinguish the skin from the inorganic materials used to create the fingerprint. It is found that the elasticity of the skin varies at 15% with increasing interval between the cut and measurement of the skin from 5 to 30 minutes. The elasticity of the skin also depends on the age of the person and is 60,2 ± 4,2 and 42,4 ± 2,6 kPa to 20 and 40 years, respectively. These dependencies can be used for creating additional levels of protection of biological identification method and preventing such methods of its compromетation as the use of moulds and pre-made cuts of skin. The results can be used in the development of biometric identification systems with a high level of protection that verifies either the fingerprint pattern of skin of human finger or its elasticity.

Cuts of epidermis of thumb skin of people aged 20 and 40 were used as experimental samples. The researches of experimental samples' topology were held by the method of SPM in a half-contact regime using probe nanoscale laboratory NtegraVita(NT-MDT,Selenograd). The cantilever NSG-10 of radius 10 nm and of medium rigidity k = 5,5 N/m was used as probe. SPMscan of skin epidermis is shown on (Fig. 1). The research of elastic qualities of experimental samples was held with the help of the method SPM in regime of force spectroscopy, with which on direct and back runs of cantilever the dependence of bend size (DFL signal) is got from the degree of moving-out of z-piestic tube of scanner (signal Height).

Moreover the researches of elastic qualities of medical silicone, plasticine and chewing gum were held for exposure of distinctive peculiarities of dependence DFL (Height) got for skin epidermis cut from dependences DFL (Height) typical for biocompatibleand inorganic materials.



(a) (b)

Figure 1. SPM scan of thumb skin epidermis: (a) topology of the surface; (b) profilogram along cutting plane line.

The measuring of skin elasticity of people aged 20 was held after 5 and 30 minutes after cut in order to exclude the possibility to break the system of biometric identification's protection within usage of the preliminary prepared skin cut.